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Number 3
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Wood As Energy

An Overview: Small-lot Wood Management

INTRODUCTION

This information package represents an effort on the part of the staff of the National Agricultural Library to assemble a variety of information about an important current topic. The lead essay prepared by a knowledgeable expert in the field discusses in some depth the specific issue.

FROM THE LITERATURE provides a representative sampling of literature available on the subject. Much of these materials were selected from the AGRICOLA database of the National Agricultural Library. An NAL call number is given for titles in the collections of the Library. The Library does not maintain a collection of audiovisual materials in this subject area. Sources are listed from which slide and filmstrips may be acquired.

The listings of **CURRENT RESEARCH** and **DEMONSTRATION PROJECTS** are taken from several databases. CRIS (Current Research Information System) is a computer based information storage and retrieval reporting system for publicly supported agricultural and forestry research in the United States. For further information contact Current Research Information Systems, NAL Building, Beltsville, MD 20705 (telephone 301-344-3850). Descriptions of demonstration projects were provided by the NARS (Narrative Accomplishment Reporting Systems) of the Extension Service, USDA, NAL Building, Beltsville, Md, 20705, telephone (301) 344-3750.

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Number 3

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Contents

SMALL-LOT WOOD MANAGEMENT

By William R. Bentley, Professor of Renewable Natural Resources, Univ. of Connecticut, Storrs, CT 06268

There are a wide variety of reasons why people own small woodlots. For some, their woodlot is a place to retreat from the world, enjoy quiet privacy, and watch nature more or less untouched by the intrusion of people's goals and objectives. For many others, the small woodlot is an outlet for their physical energy and a source of products or income. Some observers have labeled the small forest ownerships of an acre, 10 acres, or even 50 acres as examples of large backyards. The reasons for ownership are mixed, but the produce of the garden or sales from roadside stands at minimum help subsidize a source of considerable pleasure.

Increases in energy costs and the consequent increased demand for fuelwood have strengthened the practical interests of woodlot owners in producing firewood for home use or sale. Extension, the Forest Service, and consulting foresters throughout the United States are receiving questions about how best to manage timber resources for fuelwood. Management decisions for any problem require (1) clear goals, (2) real alternatives, and (3) understanding the problem context.

The context of a small-lot woodland owner includes at least three key factors with regard to wood as energy:

> <u>Forest type</u>--This includes which species to grow on the lot, which could grow, and the soils, climate, and other determinants of productivity.
>
> <u>Climate</u>--This defines the energy needs for heating homes and other buildings.
>
> <u>Money</u>--Financial priorities and cash flow situation in terms of investing in future productivity.

Contexts vary widely. At one extreme is a homeowner in the San Francisco Bay Area who cut his natural gas costs for heating in half by using wood cut from his yard as a supplemental heating source. This is a sustained yield operation from about one-quarter acre of highly productive,

intensively managed woody vegetation. The opposite extreme is in Northern Minnesota where a typical family that heats primarily with wood requires 20-25 cords per season.* It takes 40 to 50 acres managed for fuelwood to meet this need on a sustained yield basis. Owners with other priorities for their money, time, and energy are not able to achieve these results and may not be interested in managing their woodlots for fuelwood.

The problem context determines what alternatives are possible for a given small-lot owner. Alternatives can be posed as questions: What species? What size or age to harvest? What harvesting and regeneration methods? Without alternatives there are no choices or decisions to be made.

Each owner has broad objectives for a small woodlot. These need to be translated into specific goals. For example, a strictly fuelwood goal usually will lead to a different choice of managerial practices than a primary goal of wildlife and a bird habitat with fuelwood as a by-product of habitat manipuplation. A financial or economic objective may lead to fuelwood thinnings as a means of producing quality veneer logs rather than wood energy being the primary end in itself.

When it is not obvious which goals are best, an owner may want to do a tradeoff analysis. The following is an informal example of tradeoffs that face a small-lot hardwood owner in Eastern Connecticut:

<u>Primary Goal</u>	<u>Fuelwood Response</u>
1. Fuelwood	Fairly short rotations (40-50 years) with one possible thinning for kindling about 10 years before harvest; average fuelwood yields/acre/year will be high.
2. Wildlife and/or birds	Long rotations (100 years plus) with periodic thinnings or patch openings to enhance cover, edge effect, or browse sources; average fuelwood yields/acre/year will be low.

*Minnesota Agricultural Extension Service Bulletin 436, page 24 "Heating the Home With Wood" indicates that an average size home (1,500 sq. ft.) requires five to seven cords of medium density hardwood fuel for a normal Minnesota heating season. Data vary with the type of wood, heating mechanism, and severity of winter.

3.	Financial (Present net value)	Intermediate rotations (70-90 years) with commercial thinnings (starting about age 40-45) of fuelwood and pole-size materials and final harvest of veneer logs or top-quality sawlogs; average fuelwood yields/acre/year will be medium-low.

It is perfectly rational for one owner to select goal 1, another goal 2 and a third goal 3. There are good practices and bad practices for achieving each goal, but the goals themselves are equally acceptable.

Improved Practices

Fuelwood use in the United States, in both total and per capita bases, declined for over a century until the 1973 OPEC oil crisis. As a consequence, not much attention has been given to development of improved practices for managing timber stands for fuelwood until the last few years. A number of harvests over the past five years have provided ample illustration of bad practices. Some fuelwood harvests have been exploitive in character, not unlike the timber mining practices that once characterized the nation's use of its forest resources. High-value hardwood logs have been butchered into short lengths ("cookies") that are easily split, while limbs, branches and small logs have been left to rot. Four-wheel drive vehicles and tractors have compacted wet soils, reducing future productivity. Selective cuts of older, bigger trees will lead to future stands of lower value trees judged by both fuelwood and market value standards. Most of these bad practices are easily avoided, and often good practices pay dividends to the owner immediately.

There are a few key factors to consider when planning the practices for a small woodlot.

Season--Harvests in the late spring and early summer often have two advantages: (1) the cut and stacked fuelwood will be dry by the next winter, and (2) soils will be drier in the fall, winter and early spring, and less easily damaged by trucks and tractors. In areas with frozen soil, winter is the ideal time for fuelwood harvest, and it provides a full year of seasoning before the next winter's fuelwood demand.

Size and value--Bigger trees are usually easier to handle, especially when splitting "cookies" to build up the fuelwood stack. When the trees are of low quality--crooked, limby, or irregular in crossection--harvesting for fuelwood represents a substantial timber stand improvement. When the tree is straight, round, and clear of limbs, however, it may be far more valuable as a sawlog or a veneer log. With fine hardwoods, like walnut and cherry, the sale value of even the isolated individual may pay for a lot of fuelwood or other forms of energy.

Regeneration--By and large, the easiest way to regenerate the next forest is by proper harvesting practices. A selection system--one tree cut here, and one tree there--favors species that like shady environments as young seedlings and samplings. A more open harvest pattern, such as a patch cut or small clearcut, favors species that require light for the early growth forests today reflects past harvesting patterns and land uses (e.g., the old-field pine forests of the South and old-field hardwoods of New England). The harvest patterns of today will determine the forest composition on most small woodlots well into the next century.

Species

More specific guidance on improved practices can be obtained from the local cooperative extension service unit or state forestry office. In some states, on-the-ground advice can be obtained for free or for nominal fees.

The energy in fuelwood is determined by the dry weight density (weight) per cubic foot or cord. Denser species, like oak, have much more energy per cubic food than low density species, like aspen, birch, and the conifers. Many coniferous species burn hot because of the oil or pitch content, but they also produce a lot more soot and flamable residue in chimneys. More maintenance and safety checks of chimneys are required when pine, Douglas fir and other conifers are burned than when oak, alder, maple, and similar hardwoods are burned.

The species choice, however, will be influenced by other goals. A wildlife focus, for example, will give some emphasis to species diversity. A financial focus will lead to thinning low density species more than high-density species.

Local Variations

If commercial fuelwood production, instead of production for home use, is contemplated, several other factors must be considered. First, what is the best source of raw material. In the Midwest, and the southern Northeast, it may be sensible to own woodlots or purchase cutting rights for fuelwood. In much of the South and Pacific Coast, however, less expensive raw material usually can be acquired as a follow-up operation to commercial thinning or final harvests.

Some industrially-based operations have become highly mechanized with automative bucking at a landing or sorting yer and mechanical splitting. Investments in such equipment should be proceeded by careful analysis. Many northern operations overinvested in recent years because (1) fuel oil prices were projected to increase, and (2) little weight was given to competition from low wage (often underemployed) labor. Marketing also deserves careful scrutiny.

From The Literature

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(NAL Call No.: A99.9 F7634U0)

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(NAL Call No.: TP360.P77)

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Why is it So Difficult to Grow Fuelwood? Unasylva 33(131):4-12. 1981.

FILMS

The Family Forest [Motion Picture] U.S. Dept. of Agriculture, 1963. Released by National Audiovisual Center. 12 min. sd. color 16 min.

FARMING AND FORESTRY - AN INTEGRATED APPROACH

0086321
AGENCY: CSRS ILLU
PERIOD: 01 FEB 82 TO 30 SEP 87
INVEST: ARNOLD L E; KAISER C J; ROLFE G L
PROJECT#: ILLU-55-0385
PERF ORG: FORESTRY
LOCATION: UNIVERSITY OF ILLINOIS
URBANA ILL

OBJECTIVES:To develop economically and ecologically sound culture systems for land use in the lowere Ohio and middle Mississippi River valley region through integrated farming and forestry. This will include a study of the compatibility of producing tree fruits, wood and fiber products with the simultaneous production of grain crops, forage crops for hay and grazing or fiber for energy. Four promising tree species will be evaluated: white pine, black walnut, yellow poplar, honeylocust.

PUBLICATIONS:82/01 82/12

ARNOLD, L.E., MANSFIELD, M.E., KAISER, C.J. and ROLFE, G.L. 1982. Agroforestry: Farming and Forestry - An integrated approach. DSAC 10:111-112.

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FUELWOOD PRODUCTIVITY OF FAST-GROWING SUBTROPICAL TREE LEGUMES

0082137
AGENCY: CSRS HAW
PERIOD: 01 JUL 80 TO 30 JUN 83
INVEST: BREWBAKER J L; ROTAR P P
PROJECT#: HAW00802-G
PERF ORG: HORTICULTURE
LOCATION: UNIV OF HAWAII
HONOLULU HAW

OBJECTIVES:Determine growth rates, fuelwood properties, leaf meal yields and site specificities of gaint leucaenas under diverse population densities. Determine growth rates and N-fixation capabilities of fast-growing tropical leguminous tree (TLT), and assess their suitability as plantation fuelwoods. Establish seed collections, seed orchards and data banks on site adapatability and performance of fast-growing fuelwood TLT.

PUBLICATIONS:82/01 82/12

VAN DEN BELDT, R.J. 1982. Litterfall as a Function of Population in a 1-Year-Old Leucaena (K8) Planting. Leucaena Research Rept. 3:95.

VAN DEN BELDT, R.J., BREWBAKER, J.L., HU, T.-W .and BOONTAWEE BOONCHOOB. 1982. International Leucaena Population Trials. Leucaena Research Rept. 3:95-99.

BREWBAKER, J.L., MACDICKEN, K. and VAN DEN BELDT, R.J. 1982. Tropical Nitrogen Fixing Fuelwood Trees. Proc. Int'l. Seminar Energy Conservation and Use of Renewable Resources, Oxford England. (In Press).

INVESTMENT ANALYSIS OF FUELWOOD PLANTATIONS IN SRI LANKA

0087232
AGENCY: OCI IDAZ
PERIOD: 01 OCT 80 TO 30 SEP 82
INVEST: HATCH C R
PROJECT#: IDA-ES-0237
PERF ORG: FOREST WILDLIFE & RANGE EXP ST
LOCATION: UNIV OF IDAHO
MOSCOW IDA

OBJECTIVES:Determine the investment feasibility of growing woody biomass for energy in fuelwood plantations under alternative site productivity conditions and management regimes in Sri Lanka, and to identify a procedure decision-makers in developing countries can use to determine the feasibility of establishing fuelwood plantations.

PUBLICATIONS:81/01 81/12
MEDEMA, E. L., C. R. HATCH and K. A. CHRISTOPHERSEN. 1981. Investiment analysis of fuelwood plantations in Sri Lanka. FWR Experiment Station, Contribution, Contribution No. 221, 76 pp.

LANDOWNER COOPERATIVES AS A MEANS OF INCREASING FIBER PRODUCTION ON RURAL LANDS

0084998
AGENCY: CSRS NY.C
PERIOD: 27 AUG 81 TO 30 SEP 84
INVEST: LASSOIE J P; SIEBERT S F
PROJECT#: NYC-147427
PERF ORG: NATURAL RESOURCES
LOCATION: CORNELL UNIVERSITY
ITHACA NY

OBJECTIVES:To determine the factors controlling the successful operation of firewood cooperatives. To establish the extent to which cooperatives could provide forest management assistance, and to examine the extent to which churches could provide the support to establish cooperatives.

PUBLICATIONS:82/01 82/12
SIEBERT, S.F. 1983. The establishment and operation of fuelwood cooperatives in rural Northeastern United States. M.S. thesis, Cornell University, Ithaca, NY.

MANAGEMENT OF POOR OAK SITES FOR FUELWOOD PRODUCTION

0084683
AGENCY: SAES WVA
PERIOD: 01 SEP 80 TO 30 SEP 83
INVEST: WIANT JR H V; CHARLTON P M
PROJECT#: WVA00196
PERF ORG: FORESTRY
LOCATION: WEST VIRGINIA UNIV
MORGANTOWN WVA

OBJECTIVES:Investigate the potential yield of fuelwood at different stand ages, densities and composition on poor oak sites, provide silvicultural recommendations and develop field demonstration plots.

REGROWTH POTENTIALS OF EXTENSIVELY MANAGED HARDWOOD STANDS FOR FUELWOOD ON UPLAND PIEDMONT SITES

0082492
AGENCY: OCI SC.Z
PERIOD: 01 MAY 80 TO 31 OCT 82
INVEST: ZAHNER R
PROJECT#: SCZ00061-FR
PERF ORG: FORESTRY
LOCATION: CLEMSON UNIV
CLEMSON SC

OBJECTIVES:To measure and evaluate the regrowth of clearcut upland oak-hickory-mixed hardwood forests for sustained fuelwood production. To determine productivity by species composition, site quality, season of previous harvest, and stocking levels. To assess rotation sizes and ages for industry energy wood and domestic firewood. To evaluate cutting practices for fuelwood forest management.

PUBLICATIONS:82/01 82/12

ZAHNER, R., MYERS, R.K. and CHURCHILL, L.A. 1982. Site Index Curves for Young Oak Stands of Sprout Origin. Clemson Univ. Dept. Forestry Bulletin 35. 2 pp.

NR623 EXTENSION FORESTRY LAND MANAGEMENT IN MONTANA

THE FOREST LAND MANAGEMENT PROGRAM OF THE MONTANA COOPERATIVE EXTENSION SERVICE IS DESIGNED TO HELP LANDOWNERS TO INCREASE THE QUANTITY AND QUALITY OF THE TIMBER RESOURCES OF THEIR WOODLOTS.
EXTENSION RECENTLY PUBLISHED THE FIRST ISSUE OF A BIMONTHLY NEWSLETTER CALLED, "MONTANA EXTENSION FORESTRY DIGEST." IT WAS MAILED TO SOME 3,000 OWNERS OF PRIVATE, NON-INDUSTRIAL FOREST LANDS. MOST OWNERS WILL BE REACHED WITH DEVELOPMENT OF MAILING LISTS THAT ARE MORE COMPLETE.
THE PRIMARY OBJECTIVE OF THE NEWSLETTER WILL BE TO PROVIDE INFORMATION TO THE OWNERS OF TIMBER ON SUCH TOPICS AS: STAND IMPROVEMENT, MARKETING OPPORTUNITIES, PLANTING TECHNIQUES, THE USE OF WOOD AS A RENEWABLE-RESOURCE ALTERNATIVE FUEL, ETC. SUCH INFORMATION IS NEEDED BY LANDOWNERS TO INCREASE THEIR INCOME AND TO PRODUCE MORE TIMBER THAT HAS A HIGHER VALUE.
MUCH OF THE INFORMATION FOR THE NEWSLETTER IS A DIGEST OF INFORMATION FROM MANY SOURCES, CONDENSED TO PROVIDE SHORT, CONCISE INFORMATION.
THE FOREST LAND MANAGEMENT PROGRAM WAS STARTED IN JULY. IT WILL INCLUDE EDUCATIONAL PROGRAMS AND UTILIZE THE NEWS MEDIA; IN ADDITION TO THE NEWSLETTER AND DIRECT ASSISTANCE TO WOODLOT OWNERS, IT WILL HELP TO ASSURE THAT MONTANANS BENEFIT FROM LONG-TERM PRODUCTION. THE PROGRAM WILL EMPHASIZE A NEED TO IMPROVE MARKETING PRACTICES AS WELL AS PRODUCTION AND HARVESTING TECHNIQUES FOR INCREASED INCOME.
EDUCATIONAL MATERIALS ARE BEING DEVELOPED IN COOPERATION WITH THE SCHOOL OF FORESTRY, STATE FORESTRY DIVISION, U.S. FOREST SERVICE AND SOIL CONSERVATION SERVICE.

CONTACT PERSON ROY LINN, FARM SAFETY AND ENERGY SPEC.
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NR651 OVERCOMING RESISTANCE TO FOREST MANAGEMENT ON SMALLER FOREST OWNERSHIPS IN NEW HAMPSHIRE

A WELL INTENTIONED BUT UNKNOWLEDGEABLE OWNER OF A 22 ACRE WOODLOT WAS BASICALLY OPPOSED TO FOREST MANAGEMENT ACTIVITIES, PARTICULARLY ACTIVITIES INVOLVING TIMBER HARVESTING. HE REQUESTED THE FORESTRY EXTENSION AGENT TO ADVISE HIM ON SEVERAL SHADE TREES NEAR HIS HOUSE. THE EXTENSION AGENT INQUIRED ABOUT THE STATUS OF THE WOODLOT AND THE OWNERS OBJECTIVES FOR IT. AFTER WALKING OVER THE WOODLOT WITH THE OWNER AND INFORMING HIM OF THE OPPORTUNITIES FOR MANAGEMENT AS WELL AS CORRECTING SEVERAL MISCONCEPTIONS ABOUT TIMBER HARVESTING THE OWNER BECAME ENTHUSIASTIC ABOUT THE POSSIBILITY OF MANAGEMENT. THE OWNER LATER CONTACTED A PRIVATE FORESTRY CONSULTANT WHO ARRANGED AN IMPROVEMENT CUT THAT YIELDED 15 MBF OF HARDWOOD LOGS WORTH $1,900 AT THE MILL. IN ADDITION 76 CORDS OF FUELWOOD WERE PRODUCED WITH A DELIVERED VALUE OF $3,800. THIS JOB PROVIDED A LOCAL LOGGER WITH APPROXIMATELY 2 WEEKS WORK. THE FOREST NOW CONSISTS OF HIGH QUALITY HARDWOOD TREES WITH ROOM TO GROW.
INITIAL CONTACT AND FOLLOW-UP BY THE EXTENSION FORESTRY AGENT INVOLVED APPROXIMATELY 0.6 MAN DAYS.
SIMILAR ONE-ON-ONE CONTACT WITH THE OWNERS OF SMALLER WOODLOTS SHOULD GENERATE WORK FOR LOCAL PRIVATE FORESTRY CONSULTANTS AND LOGGERS, SUPPLY RAW MATERIAL FOR LOCAL MILLS, FURNISH LOW QUALITY WOOD FOR ENERGY AND IMPROVE THE MANAGEMENT OF THESE LANDS.

CONTACT PERSON ROBERT E. BURKE
CO. EXT. FORESTER
COOP. EXT. OFFICE
P.O. BOX 191
WOODSVILLE, NH 03785
(603-787-6944)

WOOD ENERGY IN WASHINGTON NR104

HALF THE RESIDENTS OF THE STATE ARE UTILIZING WOOD AS AN ALTERNATIVE ENERGY SOURCE. PROBLEMS RESULTING FROM THIS INCREASED USE OF WOOD FOR FUEL INCLUDE THE GENERAL LACK OF INFORMATION ABOUT FUEL WOOD, ENERGY VALUE AND FOREST/FUEL WOOD MANAGEMENT.
THE GOAL OF THIS PROGRAM IS TO INCORPORATE FUEL WOOD INTO FOREST MANAGEMENT WITH AN EMPHASIS IN UTILIZATION BY FOREST LAND OWNERS AND THE WOOD BURNING PUBLIC.

CONTACT PERSON ARNO W. BERGSTROM, COUNTY EXTENSION AGENT
PIERCE COUNTY COOPERATIVE EXTENSION OF WASH. STATE UNIV.
2401 S. 35TH STREET
TACOMA, WA 98409
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NR598 WOOD FOR ENERGY - KENTUCKY

KENTUCKY HAS 50 PERCENT OF ITS LAND IN FOREST COVER, OVER 90 PERCENT OF WHICH IS OWNED BY SMALL WOODLOT OWNERS. THE MAJORITY OF THESE HOLDING ARE SMALLER THAN 50 ACRES. EVEN THOUGH MANY LANDOWNERS WOULD LIKE TO MANAGE THEIR LANDS MORE THAN THEY DO, THEY HAVE FOUND IT DIFFICULT TO MARKET SMALL WOOD PRODUCTS WHICH THEY REMOVE FROM THEIR LAND. THE ENERGY CRISIS AND A DEVELOPING AWARENESS OF THE IMPORTANCE OF SELF-SUFFICIENCY, CONSERVATION, AND USE OF RENEWABLE RESOURCES AS FUEL HAVE COMBINED TO MAKE SMALL WOODLOT MANAGEMENT MORE PROFITABLE.
EXTENSION SPECIALISTS HAVE UTILIZED VARIOUS MEDIA TO PROMOTE THE USE OF WOOD AS FUEL AS PART OF SOUND WOODLOT MANAGEMENT. A WORKSHOP DEVOTED TO SMALL WOODLOT MANAGEMENT ALSO PROVIDED INFORMATION AND DEMONSTRATIONS ON WOOD USE AS FUEL, INCLUDING STOVES AND FURNACES, CHAIN SAW SAFETY AND VARIOUS WOOD DENSITIES FOR MAXIMIZING HEAT OUTPUT.
INVOLVEMENT AT THE STATE LEVEL IN ALTERNATE ENERGY DEVELOPMENT AND THE ALTERNATE ENERGY DEVELOPMENT FUND PROVIDES FURTHER OPPORTUNITIES TO PROMOTE THE USE OF WOOD AS FUEL IN KENTUCKY.

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NR433 WOODLOT MANAGEMENT FOR FUELWOOD IN MICHIGAN

AS THE PRICES FOR FOSSIL FUELS GENERPLLY CONTINUE TO INCREASE MANY INDIVIDUALS ARE INSTALLING A WOOD BURNING DEVICE TO PROVIDE A SUPPLEMENTAL HEAT SOURCE. AS MORE SUCH UNITS ARE PURCHASED AND INSTALLED, THE DEMAND FOR FUELWOOD INCREASES. WHILE SOME INDIVIDUALS PURCHASE WOOD FROM COMMERCIAL SOURCES MANY OTHERS OBTAIN WOOD FROM THEIR OWN WOODLOT. THIS PRACTICE IS DESIRABLE AS LONG AS FUELWOOD PRODUCTION IS USED AS A TOOL TO IMPROVE THE QUALITY OF THE WOODLOT. HOWEVER, REMOVAL OF SPECIES FOR FUEL WHICH ARE CAPABLE OF PRODUCING HIGHER VALUE SAWLOGS AND VENEER IN DEMAND BY ESTABLISHED HARDWOOD FOREST INDUSTRIES PRESENT IN THE STATE SHOULD BE DISCOURAGED.

THE GOAL OF THIS PROGRAM IS TO PROVIDE INFORMATION WHICH WILL LEAD TO IMPROVED MANAGEMENT OF PRIVATELY OWNED FOREST LANDS. SPECIFICALLY TO CONVEY TO LANDOWNERS INFORMATION ON HOW TO MANAGE WOODLOTS FOR THE PRODUCTION OF HIGH VALUE FOREST PRODUCTS WHILE OBTAINING FUELWOOD IN INTERMEDIATE HARVESTS.

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